

REMARKS

The Office Action mailed June 5 , 2003, has been carefully reviewed and by this Amendment, claims 1-6 have been amended. Claims 1-10 remain pending in the application.

The Examiner objected to the specification as containing informalities which Applicants have corrected herein.

The Examiner rejected claims 1-10 under 35 U.S.C. 112, second paragraph, as being indefinite, and further rejected claims 1-10 under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art in combination with U.S. Publication No. 2003/0003683 to Ko et al. ("Ko") and U.S. Publication No. US 2002/0090832 to Koh et al. ("Koh").

As set forth in amended claim 1, the present invention is directed to a method for fabricating a semiconductor memory device, comprising the steps of depositing first and second insulating layers on a semiconductor substrate having a predetermined shallow trench isolation (STI) region and a predetermined deep trench isolation (DTI) region. The STI region is formed, in the predetermined region for STI, by selectively etching the second and first insulating layers and the semiconductor substrate, after which a photoresist is formed to cover the STI region and expose the region predetermined to be a DTI region. The surface of the photoresist is then cured, either by implanting high energy argon ions or through an e-beam process, causing the photoresist polymers to crosslink and thereby increasing the etch resistance of the photoresist so that, thereafter, the DTI region is formed by using only the cured photoresist and the second insulating layer as a mask. As explained in the specification, the need for a third insulating layer or hard mask is thus eliminated, which simplifies the fabrication process and reduces production cost.

Ko discloses a method for increasing etch sensitivity of photoresist material but does not disclose or suggest the implantation of argon ions to cure the photoresist as claimed by the present invention. Instead, Ko teaches a photoresist containing a composition of silicon which is hardened through reaction with an atmosphere containing oxygen or nitrogen (see paragraphs 0030 and 0031). Argon, to the extent it may be present, is an inactive gas only and cannot be used in substitution for the oxygen or nitrogen used to produce the silicon compound necessary to harden the top layer of the photoresist in the manner taught by Ko. Accordingly, there is nothing in Ko to suggest the implantation of argon ions as set forth in amended claims 1-3.

Koh teaches a method for removing defects between an anti-reflective coating layer and a photoresist by forming a carbonized layer *on the top surface of the organic anti-reflective coating through the evaporation of solvents in such anti-reflective coating layer*. While the carbonized layer is formed using a curing process such as ion implantation or e-beam curing, there is nothing to suggest the use of argon ion implantation or e-beam processing *to cure the photoresist itself* such that the resulting cured photoresist is sufficient, with only the second insulating layer, to be used as a mask in a later etching process, as claimed by the present invention.

In summary, Applicants' use of argon ion implantation to cure the photoresist layer and eliminate the need for a third insulating layer is not suggested by the prior art in the absence of Applicants' own claimed invention, which cannot be relied upon in finding obviousness. For at least the foregoing reasons, Applicants respectfully request reconsideration by the Examiner of amended claim 1, taking into account the full combination of the elements presented.

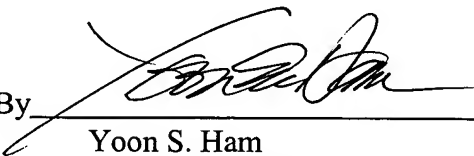
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Claims 2-10 are also in condition for allowance as claims properly dependent on an allowable base claim and for the subject matter contained therein. Specifically, the prior art does not fairly teach argon ion implantation into the photoresist in the concentration and with the implanting energy set forth in claims 2 and 3, nor does the art show the use of an e-beam curing process such as that set forth in claims 4 and 5 to cure a photoresist. Favorable reconsideration is therefore requested.

With the amendments set forth herein, the application is believed to be in condition for allowance. Should the Examiner have any questions or comments, the Examiner is cordially invited to telephone the undersigned attorney so that the present application can receive an early Notice of Allowance.

Respectfully submitted,

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